BASIC INFORMATION

SG Application/ Registration No.:	9792084-7		
United Kingdom/European Patent No.:	0561778	**Date of filing of United Kingdom/European Patent:**	02/Nov/1990
Title of Invention:	STRUCTURAL ASSEMBLY SYSTEM		
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International Patent Classification:	E04C 2/52, E04B 9/04, E04B 5/02, E04G 9/00, E04F 13/08, E04B 1/16		
Patent Agent:	ELLA CHEONG & G MIRANDAH		
SG Publication No.:	42299		

Description

This invention is directed to heavy construction attachment systems, in particular, to a system incorporating major disassemblable units and to the units of the system.

In the construction industry, concrete foundations are commonly manufactured by using formwork into which concrete is poured. This formwork usually consists of re-usable wood and aluminum composite studs and joists which provide a supporting crib-work or lattice for the actual sheathing members onto which the concrete is poured. The sheathing frequently consists of plain or paper faced plywood members. Thus, a substantial plywood sheathing sheet for example 3/4 inch (approximately 1.9 cm) ply, having a replaceable paper liner as the casting surface, is usually nailed to an underlying supporting joist having an inset nailing strip. After the concrete has set, the underlying formwork lattice and plywood is removed. Frequently the plywood has to be torn down, owing to the entrainment of the attachment nails into the concrete. Similarly, the face of the plywood may be penetrated by the concrete and become damaged. The wood nailing strips of the supporting latticework will become damaged over time due to repeated reuse and will have to be replaced. Considerable expenditures in material and labour costs are therefore involved, and valuable resources are used up.

The present method of manufacturing concrete foundations also has a drawback in that seam outlines of the 4 x 8 foot (about 122 x 244 cm) sheathing sheets, caused by misalignments, gaps and penetrating cement flashings must be ground away where a smooth finished surface is required.

The use of hook and loop elements for the purpose of joining flexible elements is not new. The garment and footwear industries have for many years employed a particular hook and loop type attachment material, commonly referred to by the trade mark VELCRO, for securing the adjacent surfaces of clothing and footwear. However, this material is limited both by the presently available widths, which do not exceed four inches (about 10 cm), and by the maximum anchoring force developed by the plastic hook elements. Furthermore, prior usage appears to have been concentrated on the application of this type of fastener in areas where a peeling, wave-like relative movement can be used to attach and detach a pair of complimentary hook and loop surfaces, as when opening a garment or a shoe flap or on the installation of decorative, non-structural panels such as shown in Wilson, U.S. Patent Number No. 4,744,189 issued May 17, 1988 or room dividers such as shown in Curatolo, U.S. Patent No. 4,090,335 issued May 23, 1978.

European Patent Application No. 329 925, published August 9, 1989 describes a plaster board having a surface substantially covered by one part of a hook and loop fastening system. A finishing sheet or a structural support member having the complementary part of the hook and loop fastening system may be used for attachment of the board to either or both of the finishing sheet and support member.

European Patent Application No. 288 393, published October 26, 1988 discloses a sealing material for cement. A polymeric sheet having loops on one side is placed on fresh cement to be sealed, loops embedded in the concrete becoming set therein to fasten the sheet to the cement.

In one aspect, the present invention provides an in situ building structure such as a wall, ceiling or floor formed on site from a settable material and having at least a first surface and an overlay covering having a rear surface embedded in the first surface. The overlay covering includes a front surface substantially covered in a part of a hook and loop fastening sytem.

In a particular embodiment of the building structure, the first surface is substantially planar. The rear surface can have structural means for embedding into the material. Such structural means can be a part of a hook and loop fastening system. The rear surface of the overlay covering can be treated to facilitate bonding to the material.

It is possible for the building structure to be supported by a form work having a complementary part of a hook and loop fastening system that is detachable from the overlay covering.

Further, the building structure can include a substantially planar first surface and a substantially planar second surface opposing the first surface. It can include a further overlay covering including a front surface substantially covered in a part of a hook and loop fastening system and an opposing rear surface wherein the rear surface of the overlay is embedded in the second surface.

In another aspect, the invention includes a system for construction of building elements cast in situ of settable material and includes walls, ceilings and floors. The system comprises a temporary assembly including a plurality of rigid components for assembly in layered, substantially planar facing relation. In such an aspect, there is a first component sheet member manufactured having a first part of a hook and loop fastening system substantially uniformly adhering to, covering and supported across at least a first surface of the sheet member. There is a second component manufactured having a second part of a hook and loop fastening system of complementary attachability to the first part and substantially uniformly adhering to, covering and supported across at least a second surface of the

support member. There is a removable covering secured in detachable, substantially concealing relation to the sheet member along a third surface. The covering layer can have a fourth surface having attachment means to enable bonding of the covering layer with concrete when cast thereon. Alternatively, the covering can have a fourth surface having release means to preclude bonding of the covering layer with concrete when cast thereon and to facilitate removal of the covering layer from the concrete when the concrete is set.

In such a system, the first and second components can be such that they can be sized on site and detachably engage each other in an assembled system.

There can be a plurality of construction layers, having the parts of the hook and loop system between more than one pair of interfaces of the construction layers.

The first and second surfaces can both be substantially planar and similarly inclined, and they can both be horizontal.

The sheet member may be a wall sheathing member.

One or more of the components can be of generally uniform cross-section at areas where they are to be cut.

The sheet member of the system can be a sheathing member and there can be a number of support members that are joist members, each joist member having a second part of a hook and loop fastening system substantially uniformly adhering to, covering and supported across a third surface opposing the second surface. There can be a third component including a plurality of beam members having a first part of the hook and loop fastening system of complementary attachability to the second part of the third surface substantially uniformly adhering to, covering and supported across at least a fifth surface.

The system can include a plurality of the sheathing members having mutually substantially abutting edges, each sheathing member having a first part of the hook and loop fastening system, substantially uniformly supported across an upper surface. The covering layer can include an overlay cover having a lower surface substantially covered with a second part of the hook and loop fastening system of complementary attachability to the first part of the upper surface, secured to the upper surface of the sheathing members and located to cover the abutting edges to preclude liquid concrete from entering the area of the abutting edges.

In another aspect, the invention includes a method of constructing a wall, ceiling or floor. The method includes a step of erecting a formwork, the formwork having a sheathing member having a front surface and having a part of a hook and loop fastening system on the front surface and an overlay covering substantially covered on a front surface thereof with a part of a hook and loop fastening system of complementary attachability to that on the first surface of the sheathing member, and having an opposing rear surface. The front surface of the overlay covering is fastened to the front surface of the sheathing member through the fastening system. The method includes a step of pouring a settable material against the rear surface of the overlay covering, the step of setting the material and the step of dismantling the form work from the structure, including removing the sheathing member.

As part of the method, the rear surface of the overlay cover can have release means to preclude bonding of the overlay cover to the settable material.

The method can also include a step of embedding a portion of the rear surface of the overlay covering in a first surface of the settable material adjacent to the rear surface. Further, that portion of the overlay covering which is embedded in a settable material can have structural means on the rear surface of the overlay covering which forms a bond with the settable material when the material sets. The structural means can be part of a hook and loop fastening system substantially covering the rear surface of the overlay covering.

The method can further include the step of treating the rear surface of the overlay covering, prior to pouring the material, in order to facilitate bonding to the material.

The sheathing member of the method can have a first surface opposing its front surface, and have a part of a hook and loop fastening system on the first surface. The formwork can include a support member having a part of the hook and loop fastening system of complementary attachability to the part of the hook and loop fastening system on the first surface of the sheathing member on a second surface, wherein the sheathing member and support member are fastened by their respective parts of the hook and loop fastening system.

Thus, according to one embodiment a carpet or other floor covering having suitable fastening elements on the undersurface, or ceiling panels or tiles having appropriate fastening elements on the upper surface may be readily, detachably secured to an appropriate structure. Similarly, wall surfaces for partitions and the like can be attached to a stud system. Also, the elements of the stud system may incorporate such complementary layered fastening elements.

In another embodiment a structural member having a first surface with a layer of surface connecting means first component parts mounted to a backing sheet and bonded to the member is pro-

vided with a removable protective cover secured thereover in protective relation, the protective cover including on one face thereof a layer of surface connecting means second components complementary to the first components of the connecting means, to permit the attachment and removal of the protective cover and exposure of the surface layer of connecting means first components. Such an embodiment may comprise a floor and sub-floor construction, wherein the protective cover remains in place during the completion of construction, so as to protect the surface connecting means therebeneath. Subsequently, a carpet or other covering may be substituted wherein the protected underlying connecting components are utilized to removably secure the covering to the sub-floor.

In general, the area fastening elements of complementary hooks and loops are of synthetic material, formulated in layers attached to backing sheets to facilitate area coverage by way of the attachment means, so as to develop the requisite attachment strength.

Certain embodiments of the invention are described, without limiting the invention thereto, reference being made to the accompanying drawings, wherein:

Figure 1 is a general view of a concrete formwork system in accordance with the present invention, in partially exploded relation;

Figure 2 is a general view of a structural floor system in accordance with the present invention;

Figures 3 and 4 are general views of structural elements incorporating component connecting means in accordance with the invention;

Figure 5 is a sideview section of a poured ceiling or roof incorporating one element of a connecting means combination in installed relation therewith.

Figure 6 is a view similar to Figure 5, the ceiling incorporating the complementary elements of the connecting means combination.

Figure 7 is a general view in exploded relation showing the elements of a portion of a partition wall embodying the invention.

In the making of the present invention it will be appreciated that certain inherent deficiencies and limitations of presently available hook and loop fasteners, such as the presently limited width of four inches in the VELCRO product, and the present upper limit on its gross developed joint strength can be overcome by the provision of wide width sheets of the respective hook and loop elements, the development of elements of improved characteristics and the adoption of improved manufacturing processes for the fasteners. An aspect of the components presented is the integration of a hook and loop fastening system into the surfaces of the products. What is described is an incorporation of this system directly into the elements comprising the building system. This aspect is required in order to provide the necessary flexibility of attachment when products are to be transported to the site as standard components or cut and fit on site for assembly into a building.

In addition, the invention presented in this application as well as European Patent Application No. 89101267 for an ANCHOR BOARD SYSTEM are not fastening products per se but rather are new designs of conventional building materials.

Referring to Figure 1, a concrete formwork assembly 10 comprises a number of supporting struts 12 carrying beams 14 across which are laid joists 16, to which sheathing sheets 18 are secured.

A covering 41 overlays the gaps or joints 39 between adjoining sheathing sheets 18. At the interfaces 11, 22, 24 between the respective rigid components 14, 16, 18 area fastening elements comprising loops 27 and hooks 29 are located, to attach the respective components in securely anchored relation.

The covering 41 also utilizes area fastening elements comprising loops 27 and hooks 29 to secure it to the sheathing sheets 18.

Referring to Figure 2, a portion 30 of a floor construction is shown. Illustrated are fabricated joists 32, each comprising a pair of opposed flanges 34, 36 having a web 38 secured therebetween. Such joists 32 can be of extruded light alloy such as aluminum, or fabricated of metal, or of wood and plywood as indicated.

The ends of joists 32 usually are supported by peripheral basement walls (not shown).

A subfloor comprising panels 40 is supported by joists 32. At the interface contact areas 46 and 47 are located area fastening elements secured to the respective components comprising loops 27 and hooks 29, to hold the respective components in mutually anchored relation. A flexible, protective cover sheet 50 overlies the upper surface of floor panels 40, being arranged to cover the floor panel intermediate gaps or joints 39.

During the erection of a building, sheet 50 may comprise a protective over-flooring element, to safeguard the underlying, upwardly extending hook portions 29 against damage from above. Once the building is erected and the finishing work completed, the protective sheet 50 can be removed and 4 x 8 foot (approximately 122 x 244 cm) sheets of plywood for a flooring system having a complementary loop layer on the underface thereof or a covering carpet with a looped underface, as disclosed in US-A-4 822 668 can be installed.

Figure 3 shows a substantially rigid panel 62 having a layer of loop elements 27 on one face

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SG Application/ Registration No.:	9791286-9
United Kingdom/European Patent No.:	2280916
Date of filing of United Kingdom/European Patent:	08/Apr/1993
Priority claimed:	10/04/1992 GB 9208015
Title of Invention:	BUILDING PANEL AND BUILDINGS MADE THEREFROM
Applicant/Proprietor:	MICHAEL STEVEN ANDREW BALLA-GODDARD TYN YR ERW, CLAWDDNEWYDD, RUTHIN, CLYWD, LL15 2NF UNITED KINGDOM PHILIP GODFREY HARRISON 2 GOSTELLA COTTAGES, DODLESTON, NR CHESTER, CH4 9LL UNITED KINGDOM ANDREW FRANCIS DENNY 5 WEST VIEW DRIVE, MYNYDD ISA, MOLD, CLWYD UNITED KINGDOM MICHAEL LEONARD BAILEY 4 CHURCH STEADINGS, WAVERTON, NR CHESTER, CH3 7QX UNITED KINGDOM GEORGE MICHAEL CONNOLLY 7 HUNTERS HILL, KINGSLEY, NR WARRINGTON, WA6 8DT UNITED KINGDOM DONALD STANLEY PASSEY 3 MYNSULE ROAD, SPITAL, MERSEYSIDE, L63 9YQ UNITED KINGDOM ANDREW STEPHEN THOMAS EVANS 23 EAST LANE, SANDIWAY, CHESHIRE, CW8 2QQ UNITED KINGDOM
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International Patent Classification:	E04C 2/26
Patent Agent:	DREW & NAPIER
SG Publication No.:	42081

2280916

BUILDING PANEL AND BUILDINGS MADE THEREFROM

Technical Field

The present invention relates to buildings and in particular to a building panel for use in constructing buildings.

Background Art

There is throughout the world a need for dwellings and other buildings that can be rapidly and cheaply constructed and there have been many proposals for constructing such buildings. However, generally, the quality of such buildings has been low and/or such buildings have not been as simple to construct as would be desirable.

It is well known to construct buildings by erecting a rigid structural framework, for example of steel girders, and to bolt prefabricated panels between the girders to provide the desired outer and inner walls. However, such buildings are expensive and time-consuming to erect. Alternatively, it is known to erect buildings and enclosures out of prefabricated load-bearing panels that are connected together to provide the desired outer walls of the buildings. However, buildings made in this way are not acceptable as dwelling because they do not meet the requirements of fire-resistance. The problem of making fire-resistant prefabricated panels is complicated if they bear substantial loads since the load tends to accelerate the disintegration of a panel when subject to fire.

It is also known to make building panels out of concrete containing a layer of insulating material. However such panels are heavy and difficult to transport and do not have good insulating properties. Also the insulation does not adhere to the concrete and so the panel is not a composite structure.

Disclosure of the Invention

According to the present invention, there is provided a rectilinear composite load-bearing building panel having a pair of opposed faces and a pair of opposed sides, the panel comprising a pair of spaced-apart rigid face sheets, a rigid insulating material sandwiched between, and adhering to, the face sheets, connecting means, which are preferably intermediate between the opposed sides, connecting the face sheets together to resist any relative movement between the face sheets both in the plane of the panel and out of the plane of the panel and wherein the opposed sides each have a profiled shape

for mating with a correspondingly profiled side of an adjacent panel and wherein the sides have means for securing them to sides of adjacent panels.

As used herein, the term "load-bearing panel" means a panel capable of withstanding compressive forces between the top and the bottom surfaces of at least 5 kN/m and preferably at least 10 kN/m: generally we aim at providing a panel capable of withstanding a compressive force of about 20 to 30 kN/m.

It is emphasized that the panel of the present invention is composite in nature, that is to say the face sheets adhere to, and therefore interact with, the insulating material to produce a panel having composite strength greater than that of the individual parts. This is to be distinguished from known case concrete building panels that includes an internal layer of insulating material since there is no structural interaction between the insulating material and the concrete and so such a panel acts as a laminar body and not a composite body. During a fire, the parts of the panel of the present invention also interact; for example, the insulating material isolates the connecting member from the high temperature of the fire while the connecting member prevents the face sheet next to the fire from buckling under the effect of the fire, thereby isolating the insulating material from the fire and also maintaining the structural integrity of the panel.

The face sheets are rigid boards (for example particle boards, cement particle boards, glass fibre reinforced cement boards, cellulose reinforced gypsum boards, crushed slate boards and resin boards; suitable boards are available under the trade names SUPALUX™, MONOLUX™, PANELCRETE™, VIROC™ and PYROC™); it is advantageous that the boards can take and retain fixings, for example nails, screws or staples; also the boards are preferably capable of being bonded to other panels or to other building elements or items by adhesive or foam injection. In addition to the above-mentioned materials, the face sheets can be made of wood, plastics material or metal. The face sheets are preferably thermally insulating and should not be made of readily combustible material. The face sheets may be treated with a fire-retardant paint to enhance the fire resistance of the panel, or may have a fire-retardant added to its composition.

The insulating material may be a rigid organic or inorganic foam, for example a foamed polyurethane or FOAMGLAS™ (which is a cellular inorganic material). The

panel is preferably made by foaming a polymer in situ between the face sheets and the materials used are advantageously such that the foam adheres directly to the board naturally so that no adhesive is required between the foam and the face sheets (as is the case of cement particle board and the polyurethane). In addition to any natural bond between the insulating material and the face sheets, the insulating material and the face sheets may be joined e.g. by adhesive or mechanically for example using a Velcro-type fastening arrangement.

The connecting means is preferably heat- and fire-resistant and it is most preferably metallic, although other materials, e.g. steel carbon fibre, fibre glass, glass, plastics, impregnated board or laminated timber, may be used. The connector must provide rigid connection between the face sheets that resists relative displacement of the face sheets both within the plane of the panel and out of the plane of the panel. The connector means is preferably elongate and more preferably vertically disposed within the panel. More particularly, the connecting means may be a stud of an "I", "C" or "Z" shaped-section. It may be solid, hollow, or of box or honeycomb construction. It need not be straight and, when viewed face-on, may be of "Z", "C", undulating, castellated or zig-zag shape. The connecting means plays an important function in maintaining the strength of the panel in the case of fire. It not only prevents the face-sheet delaminating from the insulating material and but also connects the two face sheets and so maintains the structural integrity of the panel which thus retains its composite structure and composite properties. Each panel may include more than one connecting member, the number of members in each panel depending on the size and the shape of the members, and the size of the panel. When the connecting means is in the form of a stud, there would generally be one, two or three such members. The connecting members may include openings either in the members themselves (by providing holes in the members) or between the members and the face sheets (for example by making the sides of the members abutting the face sheets as a castellated configuration) to assist the even distribution of foam to the panel.

The connecting means may themselves provide secondary load-bearing capacity, i.e. when the load-bearing capacity of a composite panel as a whole is somehow impaired, e.g. through fire. When this is the case, the connecting means can extend

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Application No.:	9801291-7 **Filing date:** 07/Jun/1997
PCT Application No.:	PCT/EP97/03006
Publication Number:	50239
Priority claimed:	11/06/1996 BE 9600527 15/04/1997 BE 9700344
Title of Invention:	FLOOR COVERING, CONSISTING OF HARD FLOOR PANELS AND METHOD FOR MANUFACTURING SUCH FLOOR PANELS
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International Patent Classification:	E04F 15/04, F16B 5/00
Patent Agent:	DREW & NAPIER
PCT Publication No.:	WO 97/47834
Date of grant of patent:	16/Jan/2001

Floor covering, consisting of hard floor panels and method for manufacturing such floor panels.

This invention relates to a floor covering, consisting of hard floor panels, as well as to a method for manufacturing such floor panels.

In first instance, the invention is intended for so-called laminated floors, but generally it can also be applied for other kinds of floor covering, consisting of hard floor panels, such as veneer parquet, prefabricated parquet, or other floor panels which can be compared to laminated floor.

It is known that such floor panels can be applied in various ways.

According to a first possibility, the floor panels are attached at the underlying floor, either by glueing or by nailing them on. This technique has as a disadvantage that it is rather complicated and that subsequent changes can only be made by breaking out the floor panels.

According to a second possibility, the floor panels are installed loosely onto the underground, whereby the floor panels mutually match into each other by means of a tongue and groove coupling, whereby mostly they are glued together in the tongue and groove, too. The floor obtained in this manner, also called a floating parquet flooring, has as an advantage that it is easy to install and that the complete floor surface can move which often is convenient in order to receive possible expansion and shrinkage phenomena.

A disadvantage with a floor covering of the above-

mentioned type, above all, if the floor panels are installed loosely onto the underground, consists in that during the expansion of the floor and its subsequent shrinkage, the floor panels themselves can drift apart, as a result of which undesired joints can be formed, for example, if the glue connection breaks.

In order to remedy this disadvantage, techniques have already been thought of whereby connection elements made of metal are provided between the single floor panels in order to keep them together. Such connection elements, however, are rather expensive in manufacturing them and, furthermore, their provision or the installation thereof is a time-consuming occupation.

Examples of embodiments which apply such metal connection elements are described, among others, in the documents WO 94/26999 and WO 93/13280.

Furthermore, couplings are known which allow to snap floor parts into each other, a.o. from the documents WO 94/1628, WO 96/27719 and WO 96/27721. The snapping-together effect obtained with these forms of embodiment, however, does not guarantee a 100-percent optimum counteraction against the development of gaps between the floor panels, more particularly, because in fact well-defined plays have to be provided in order to be sure that the snapping-together is possible.

From GB 424.057, a coupling for parquetry parts is known which, in consideration of the nature of the coupling, only is appropriate for massive wooden parquetry.

Furthermore, there are also couplings for panels known from the documents GB 2.117.813, GB 2.256.023 and DE 3.544.845. These couplings, however, are not appropriate

for connecting floor panels.

The invention aims at an improved floor covering of the aforementioned type, the floor panels of which can be coupled to each other in an optimum manner and/or the floor panels of which can be manufactured in a smooth manner, and whereby preferably one or more of the aforementioned disadvantages are excluded.

The invention also aims at a floor covering which shows the advantage that no mistakes during installing, such as gaps and such, can be created.

Furthermore, the invention also aims at a floor covering whereby the subsequent development of gaps is excluded or at least counteracted in an optimum manner, whereby also the possibility of the penetration of dirt and humidity is minimalized.

To this aim, the invention relates to a floor covering, consisting of hard floor panels which, at least at the edges of two opposite sides, are provided with coupling parts, cooperating which each other, substantially in the form of a tongue and a groove, characterized in that the coupling parts are provided with integrated mechanical locking means which prevent the drifting apart of two coupled floor panels into a direction perpendicular to the related edges and parallel to the underside of the coupled floor panels. Hereby, these coupling parts are optimalized in such a manner that they allow that any form of play is counteracted and preferably is excluded.

By integrated mechanical locking means is understood that these form a fixed part of the floor panels, either by being connected in a fixed manner to the floor panels, or by being formed in one piece herewith.